

FIGURE 1A

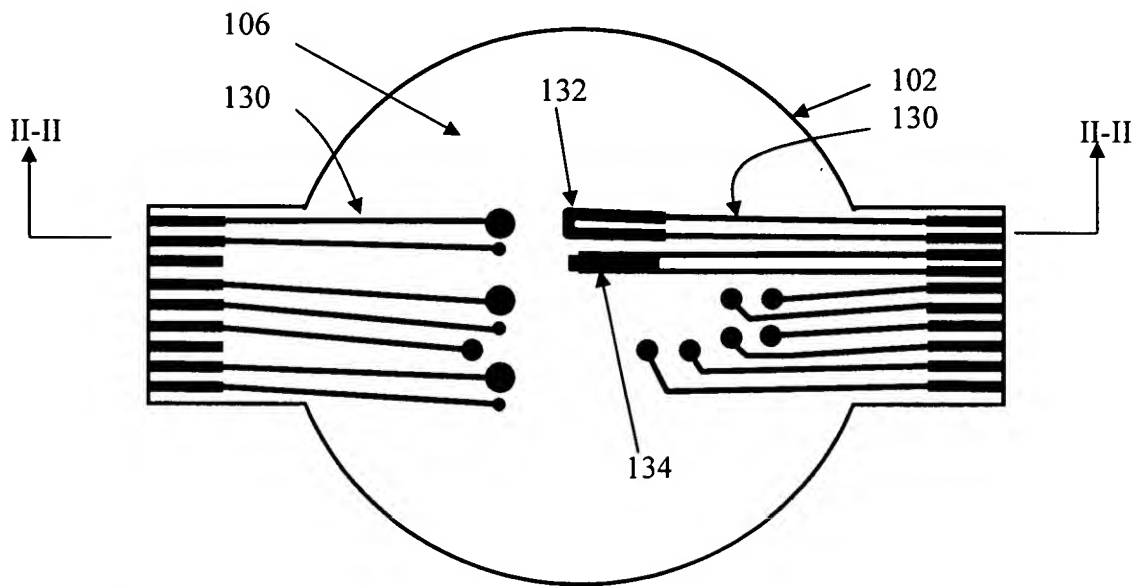


FIGURE 1B

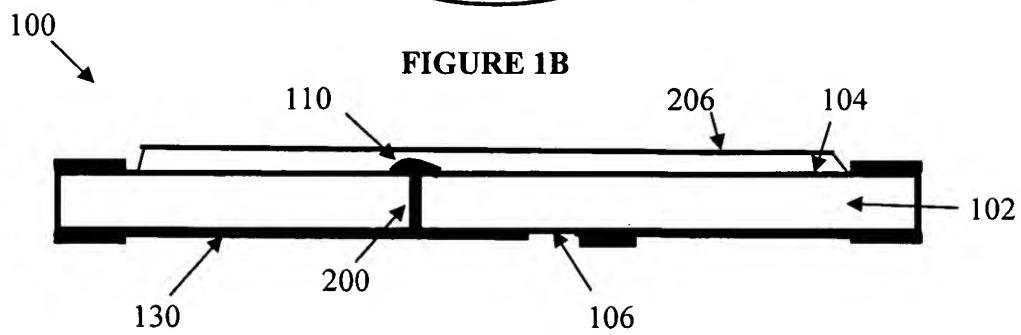


FIGURE 2

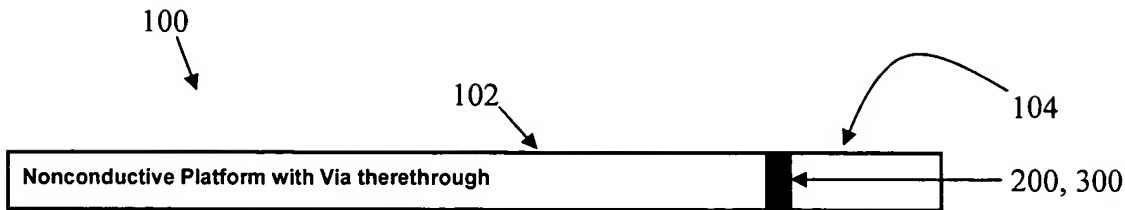


FIGURE 3A

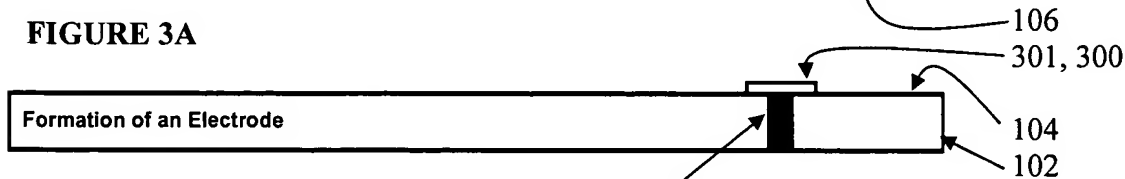


FIGURE 3B

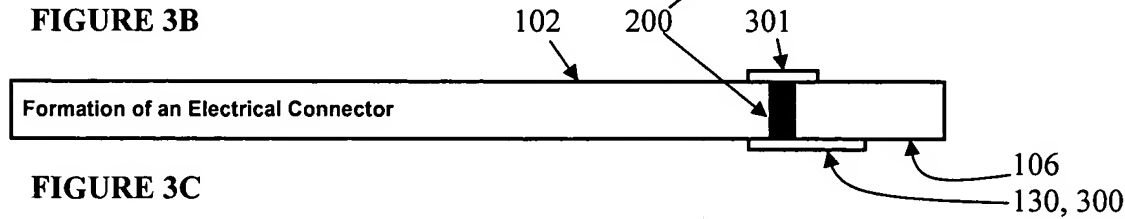


FIGURE 3C

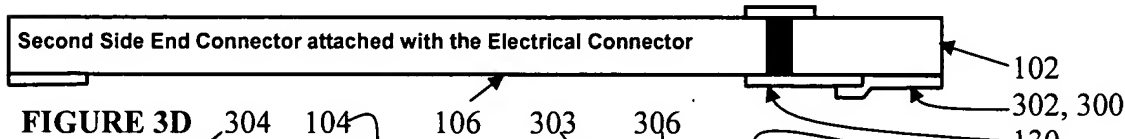


FIGURE 3D

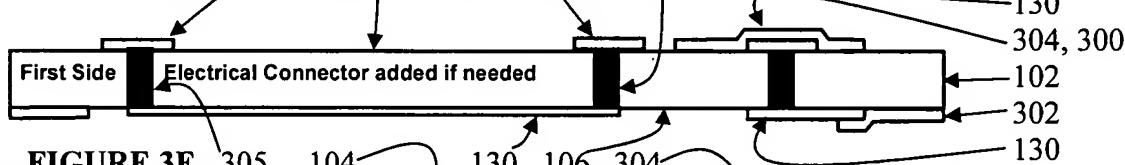


FIGURE 3E

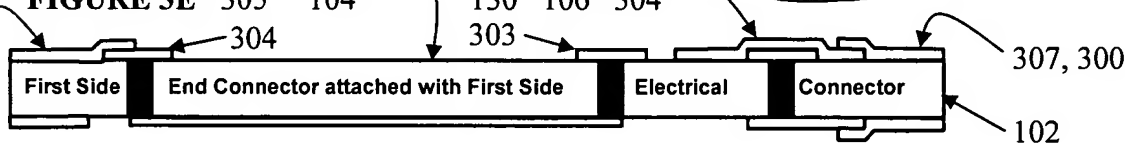


FIGURE 3F

307, 300

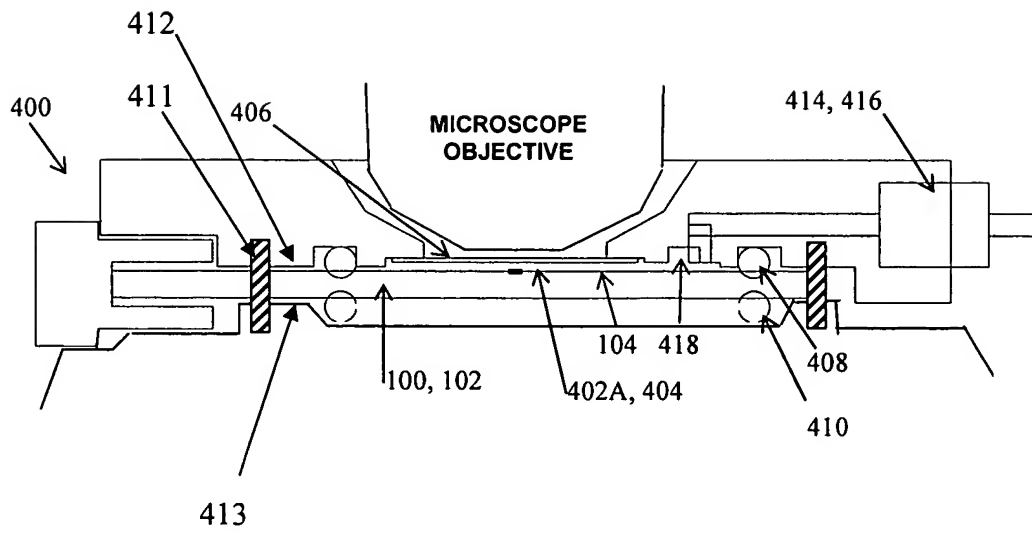


FIGURE 4A

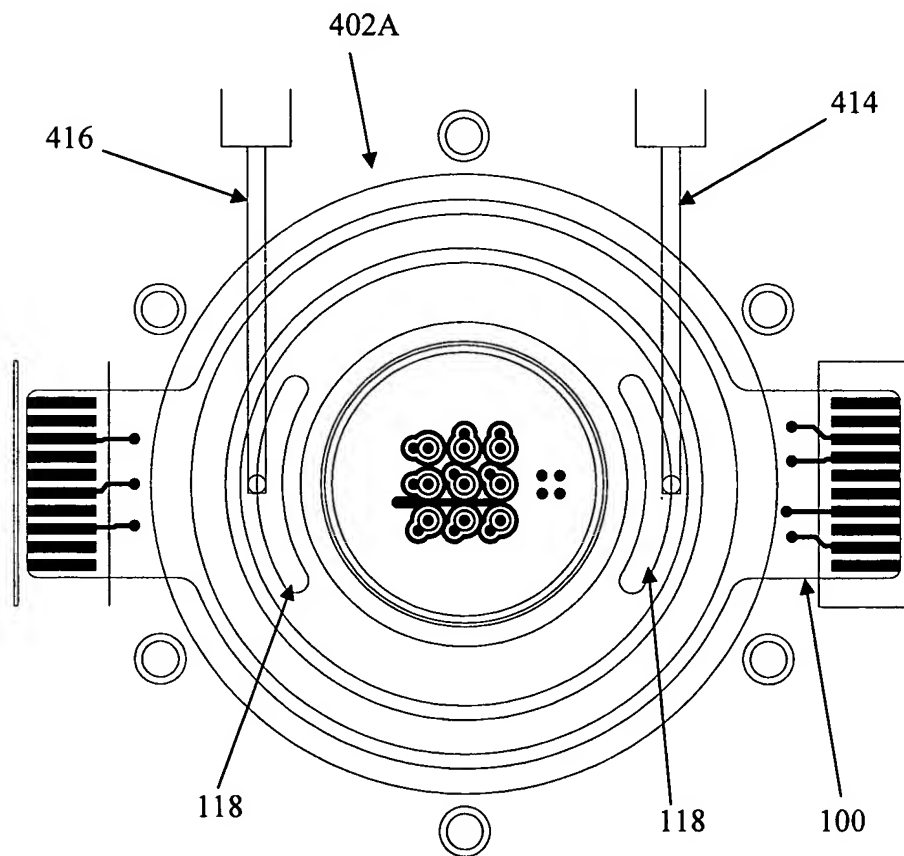


FIGURE 4B

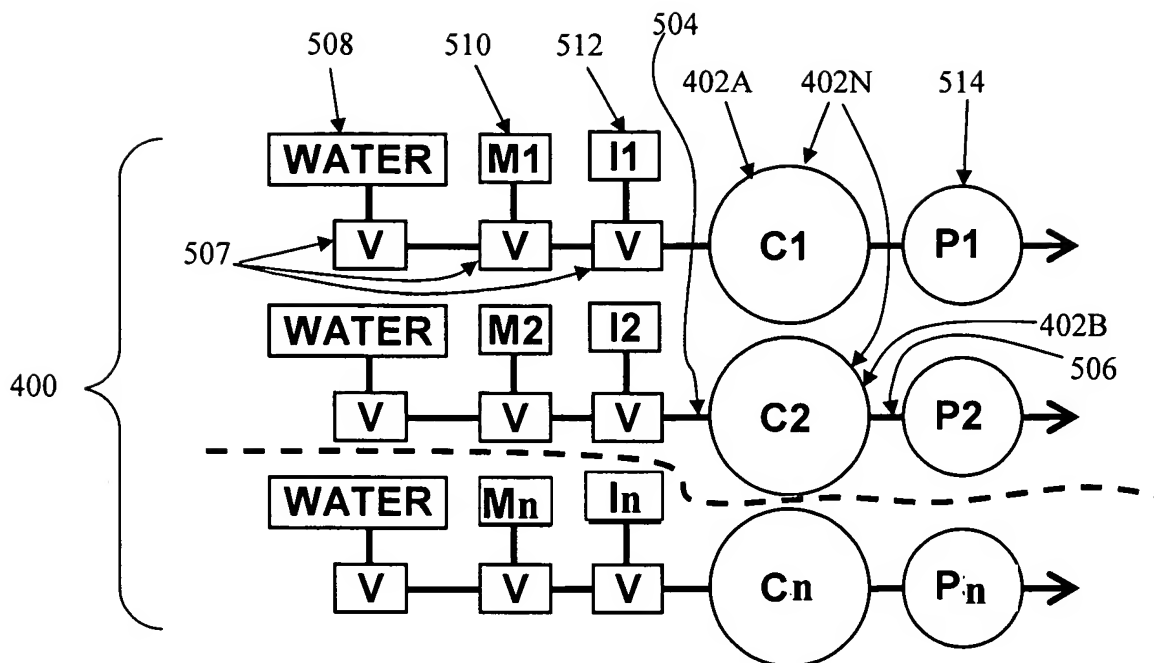


FIGURE 5

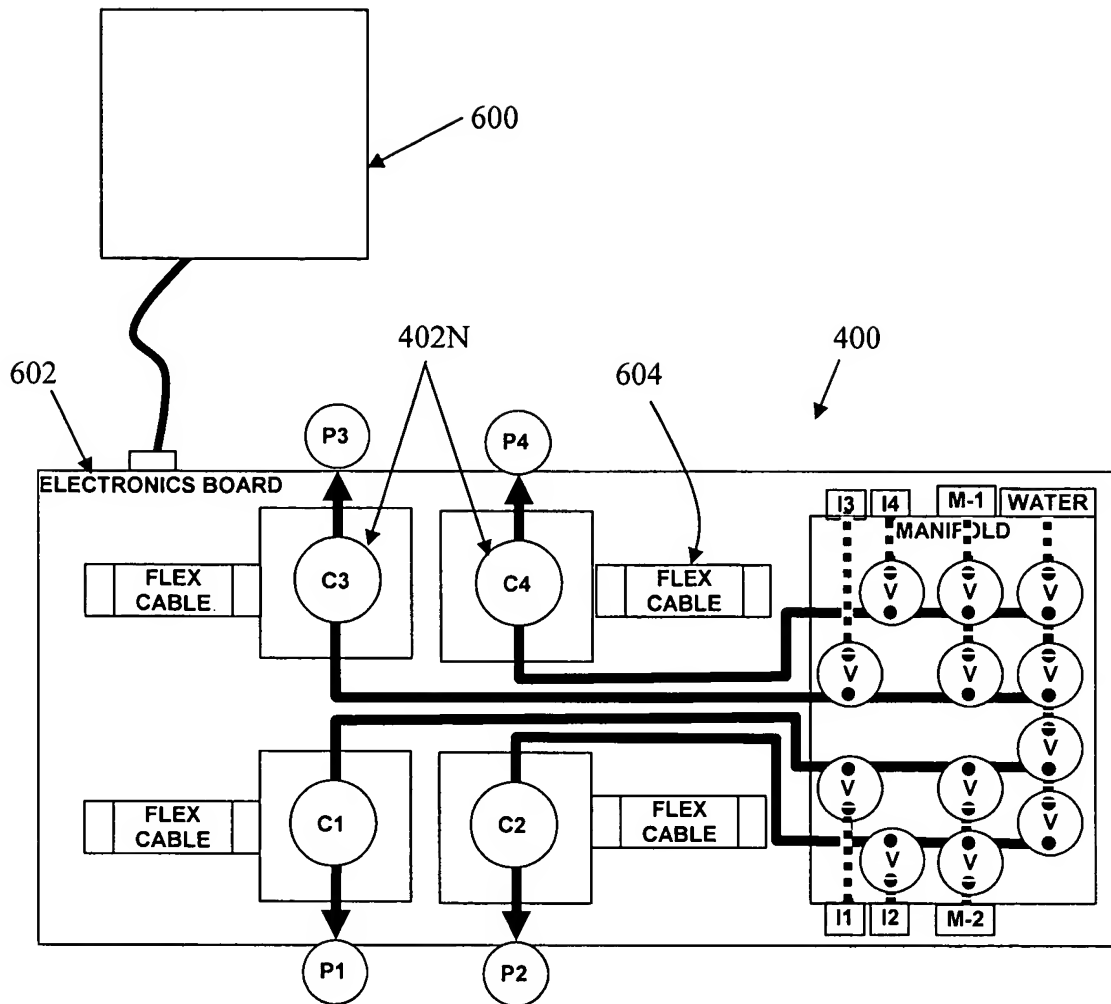


FIGURE 6

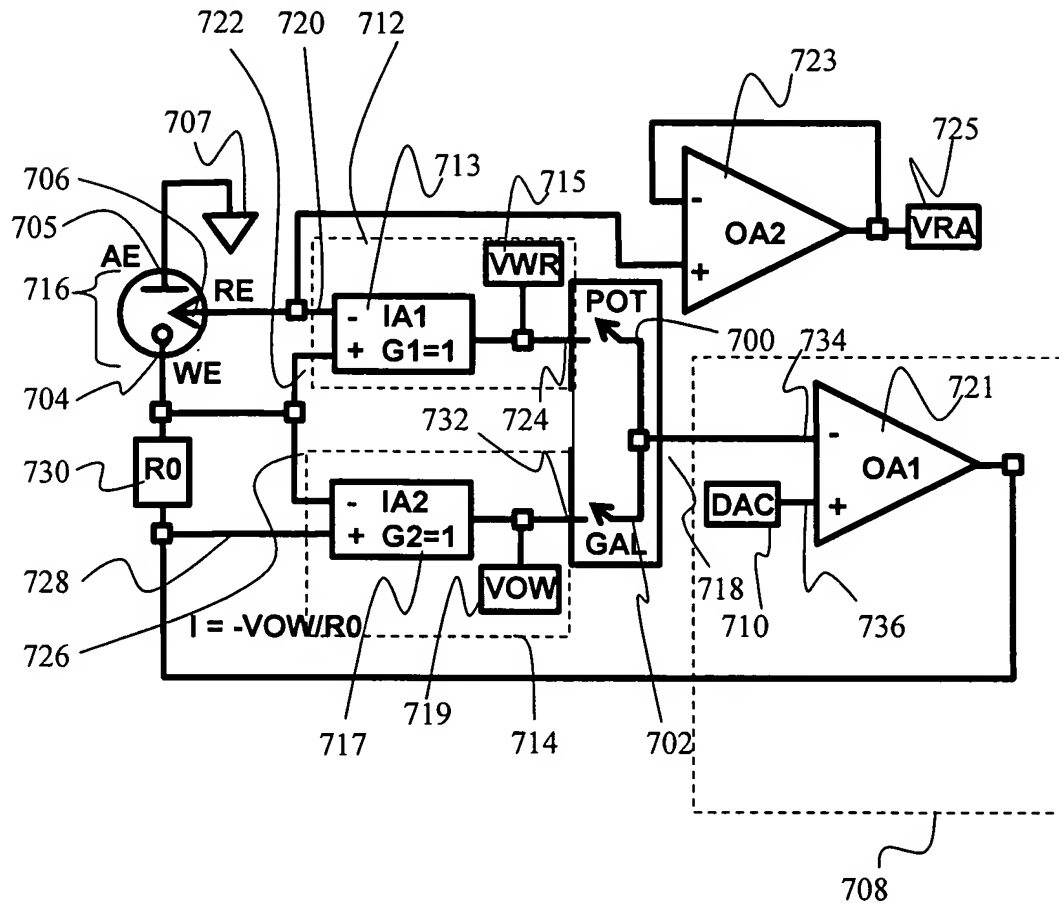


FIGURE 7A

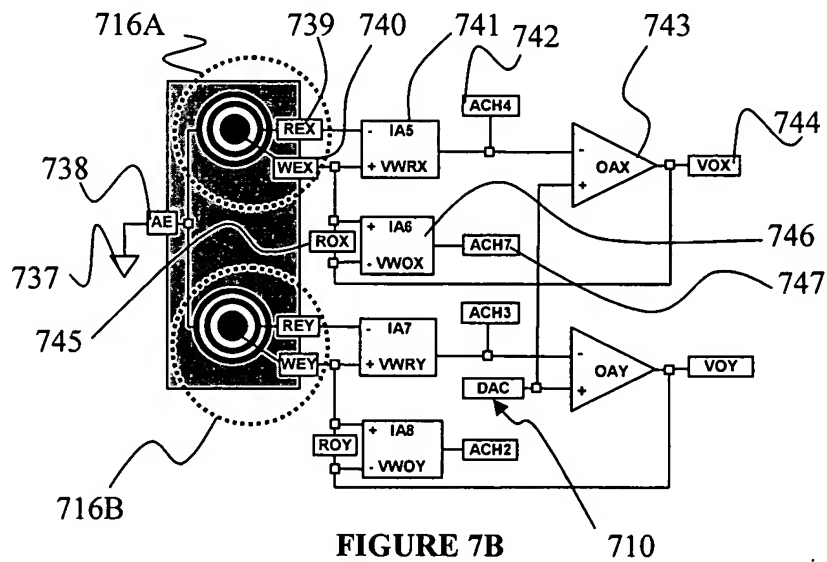


FIGURE 7B

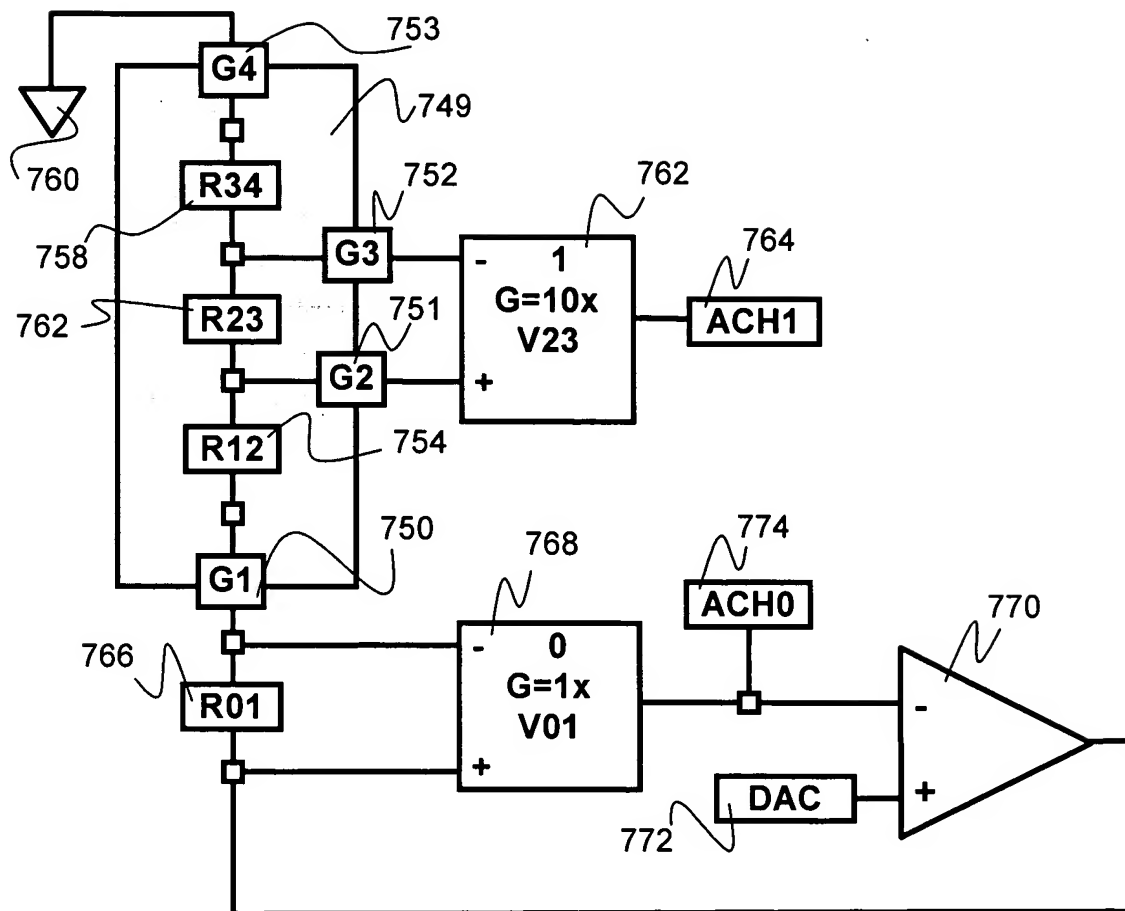


FIGURE 7C

Name	Compound	Molecular Weight g/mol	ppm= mg/L [5]	$\mu\text{M}$	$E^\circ$ V [6]
Ammonia	NH <sub>4</sub> <sup>+</sup>	17.03	0.5	29.360	-0.762
Arsenic	As	75.9216	0.01	0.132	-0.608
Barium	Ba	137.33	1	7.282	-2.912
Cadmium	Cd	112.41	0.05	0.445	-0.403
Calcium	Ca	40.08	30	748.503	-3.8
Chloride	Cl	35.45	200	5641.749	1.358
Chromium	Cr	51.996	0.05	0.962	-0.913
Copper	Cu	63.54	1	15.738	0.153
Iodine	I <sub>2</sub>	253	15	59.289	0.5355
Iron	Fe	55.85	0.3	5.372	-0.447
Lead	Pb	207.2	0.05	0.241	-0.126
Magnesium	Mg	24.3	50	2057.613	-2.372
Manganese	Mn	24.32	0.05	2.056	-1.185
Mercury	Hg	200.59	0.002	0.010	0.851
Nickel	Ni	58.69	0.05	0.852	-0.257
Nitrate	NO <sub>3</sub> <sup>-</sup>	62	10	161.290	?
Potassium	K	39.1	340	11295.681	-2.931
Selenium	Se	78.96	0.01	0.127	-0.924
Silver	Ag	107.868	0.05	0.464	-0.8
Sulfate	SO <sub>4</sub>	96.07	250	2602.269	0.172
Zinc	Zn	65.38	5	76.476	-0.762

FIGURE 8

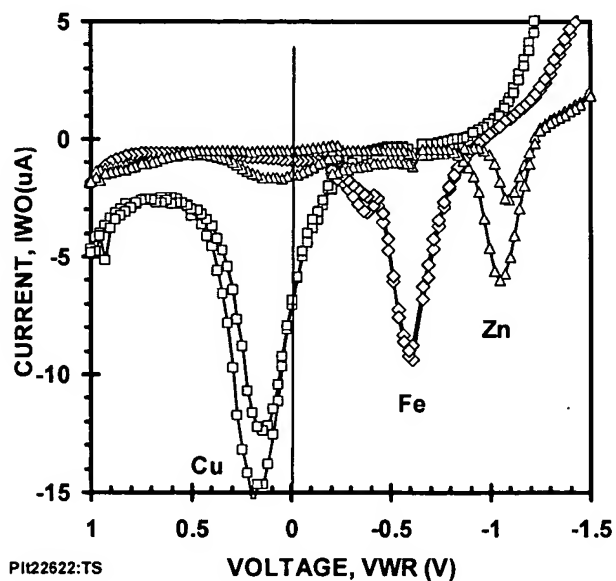


FIGURE 9



9/30

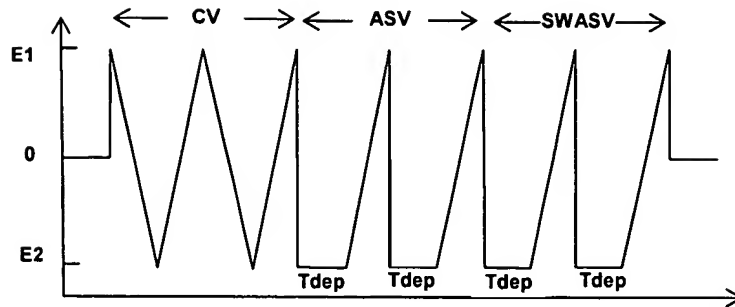


FIGURE 10

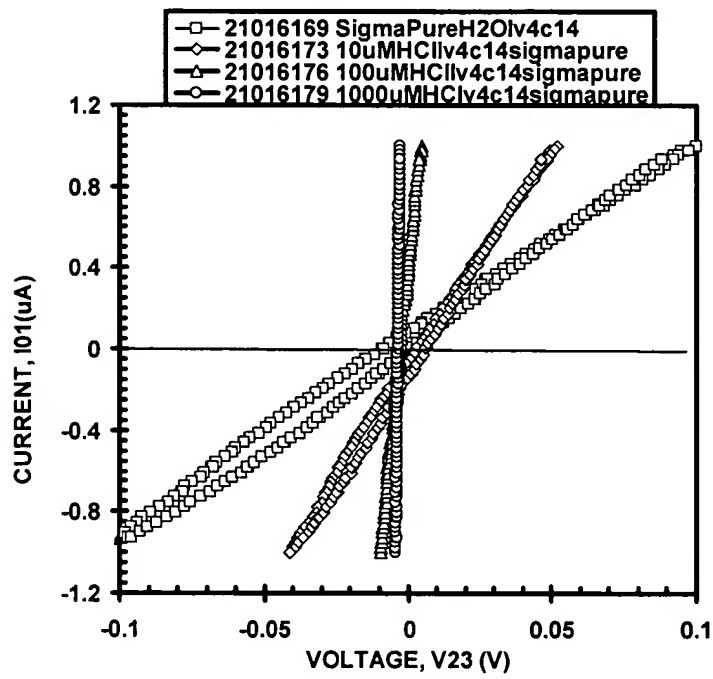


FIGURE 11

10/30

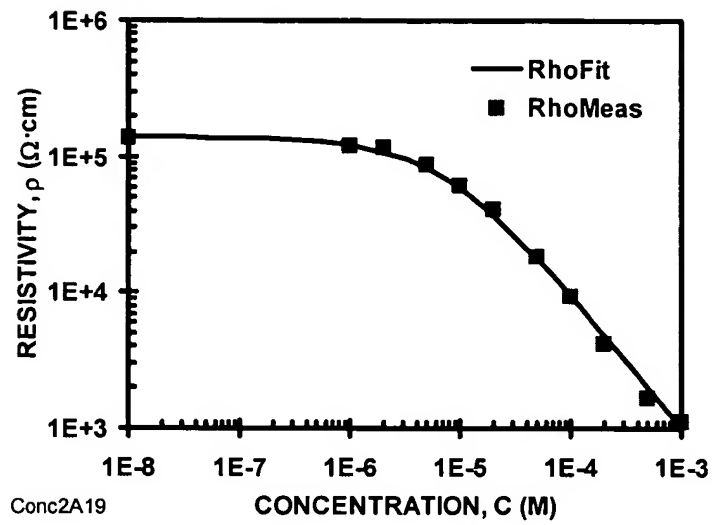


FIGURE 12

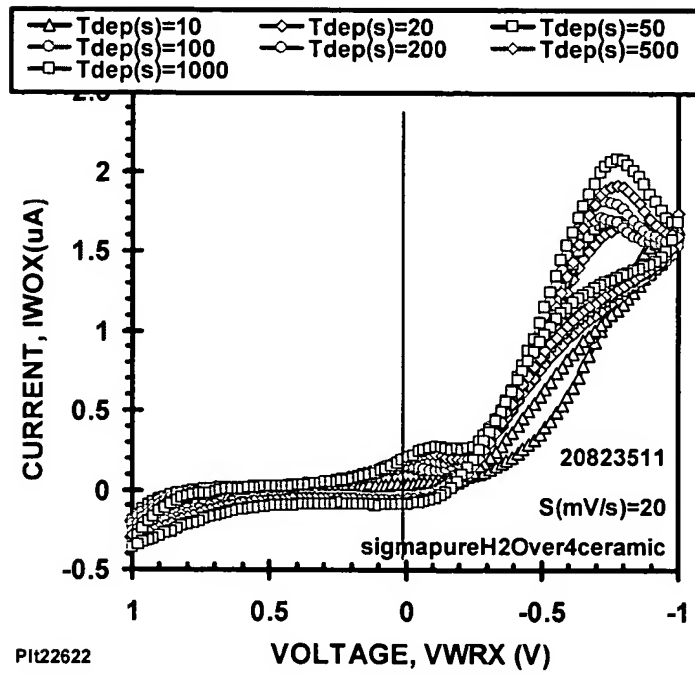


FIGURE 13

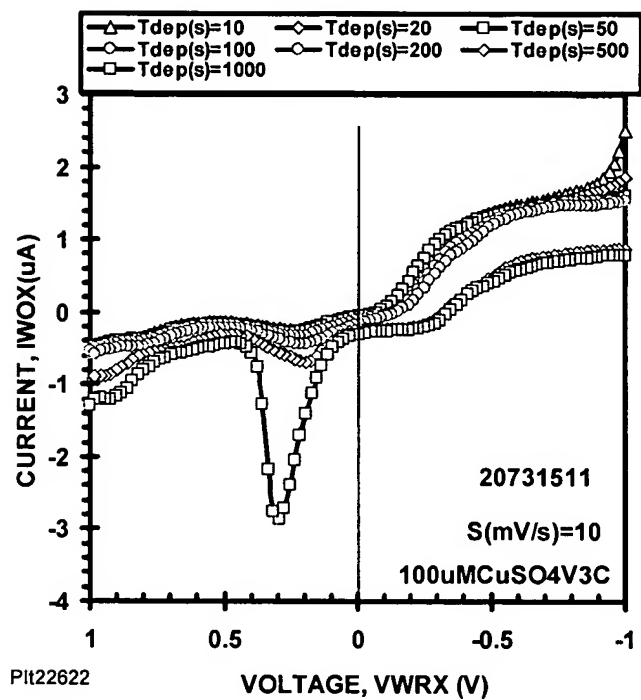


FIGURE 14A

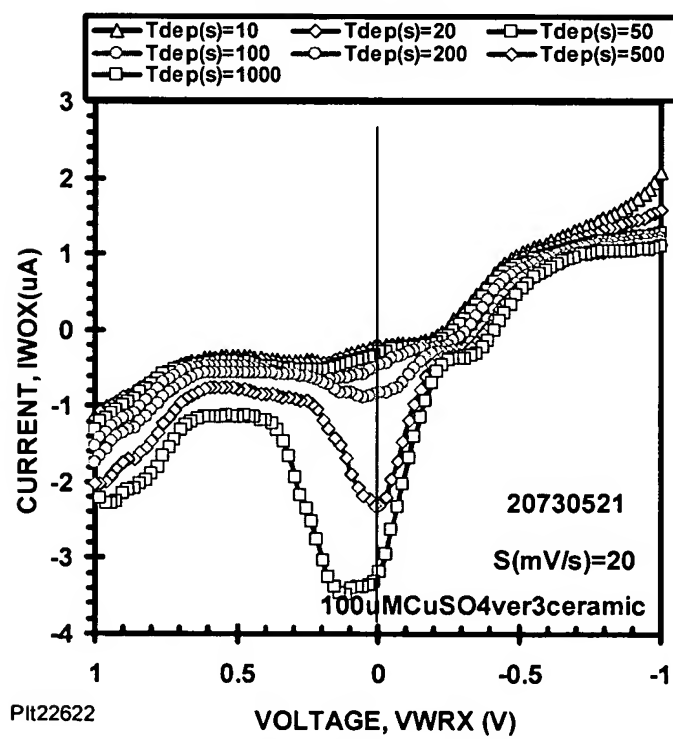


FIGURE 14 B

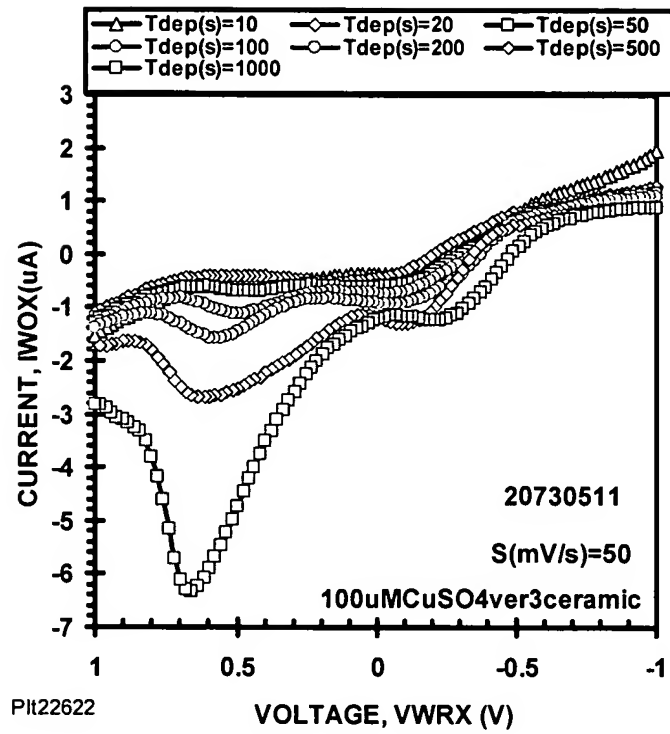


FIGURE 14C

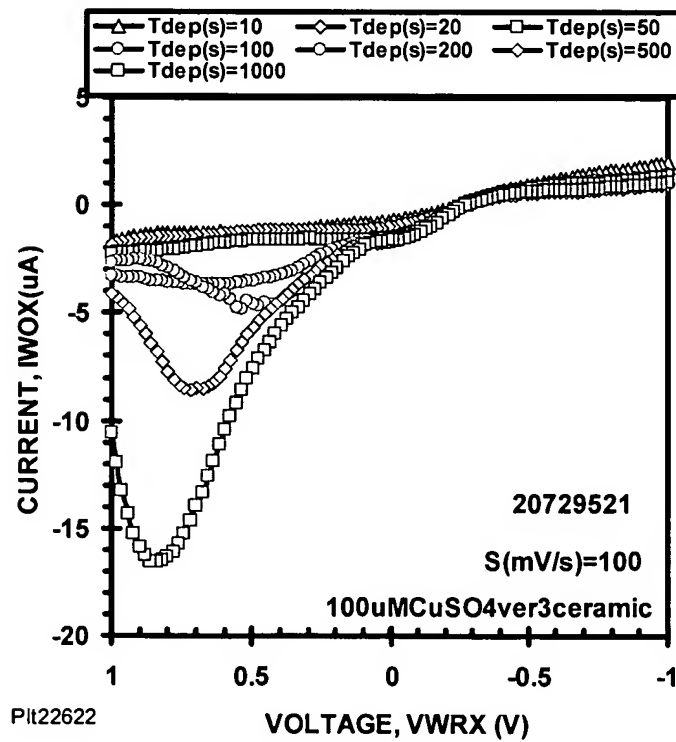


FIGURE 14D

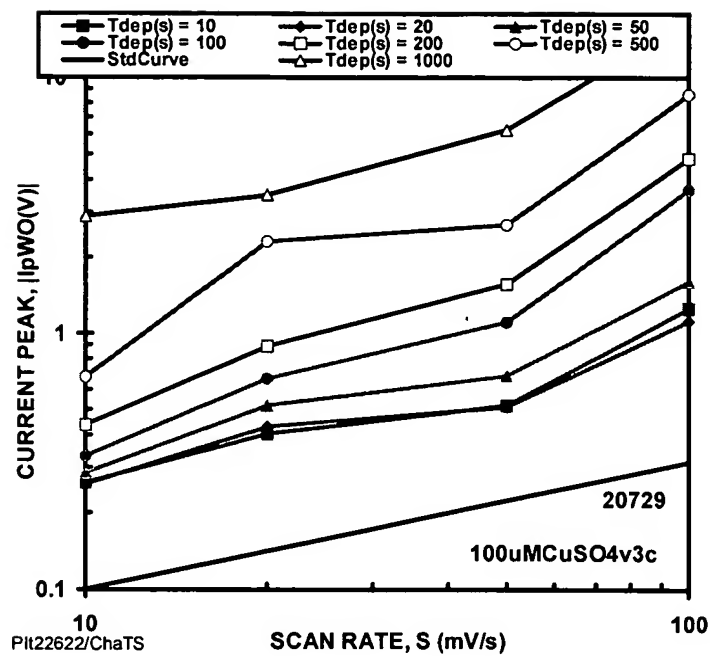


FIGURE 15A

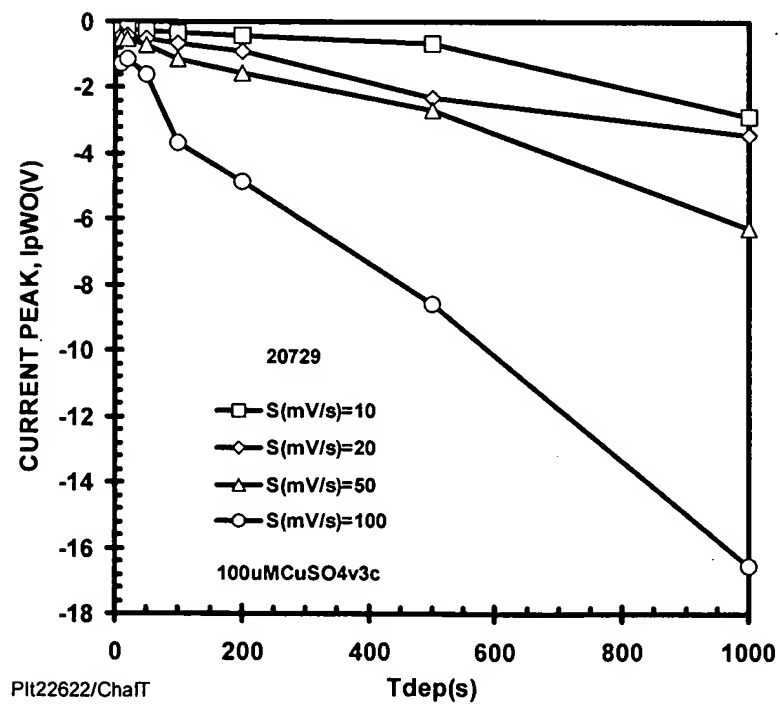


FIGURE 15B

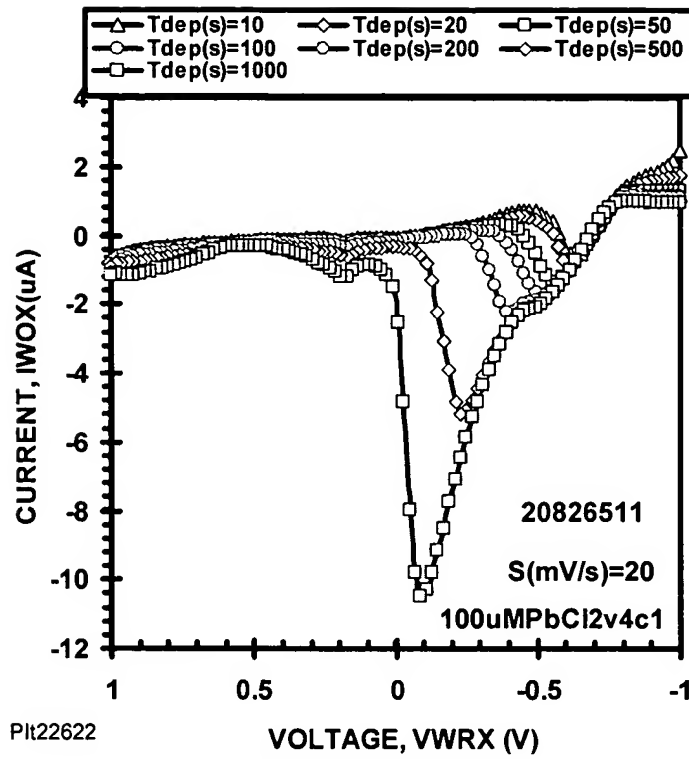


FIGURE 16A

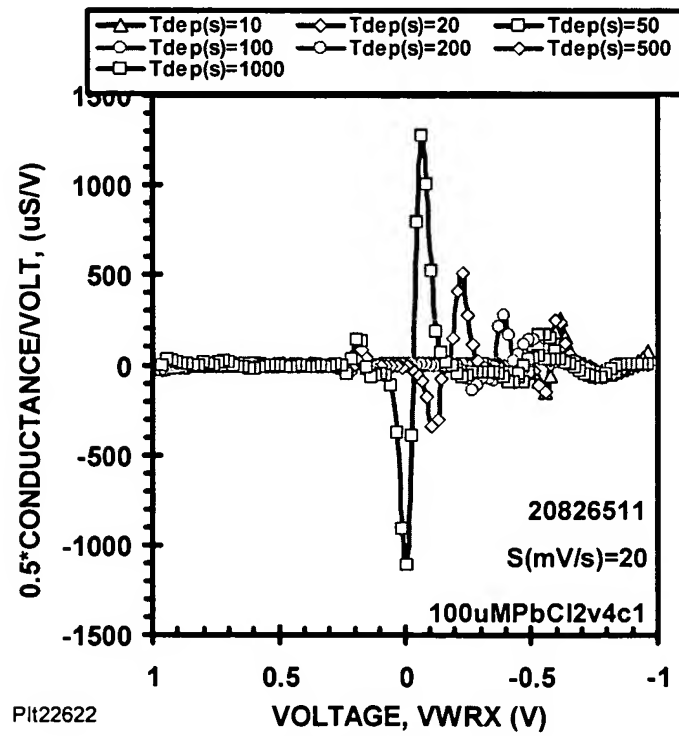


FIGURE 16B

15/30

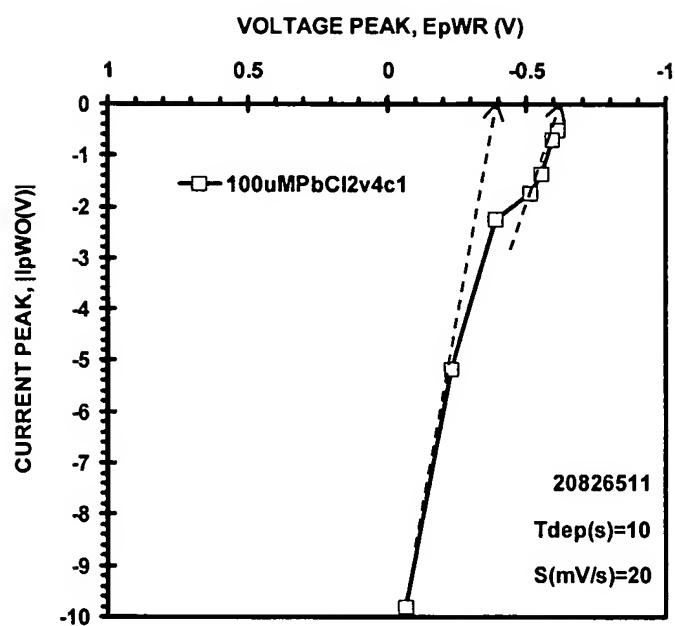


FIGURE 16C

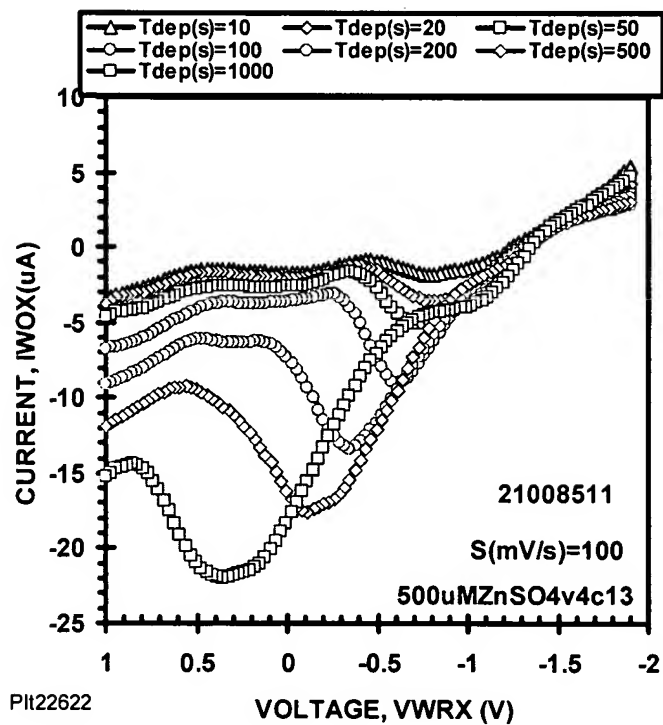


FIGURE 17A

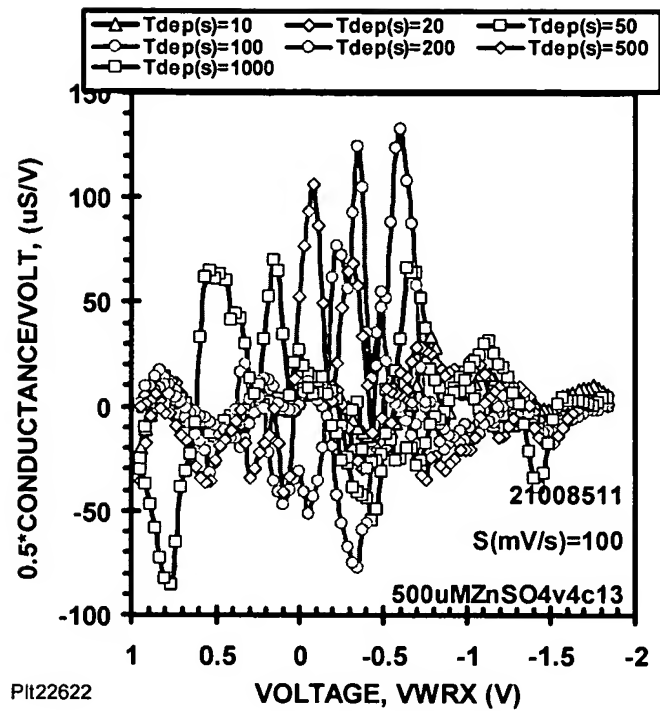


FIGURE 17B

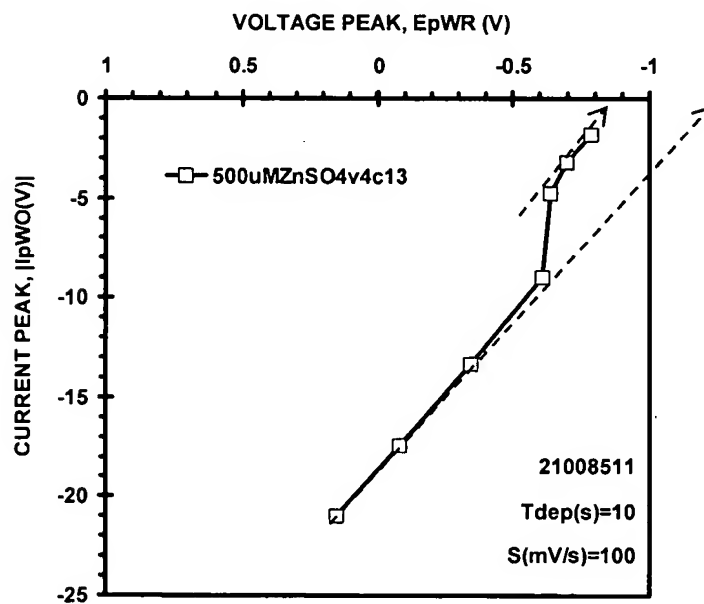


FIGURE 17C



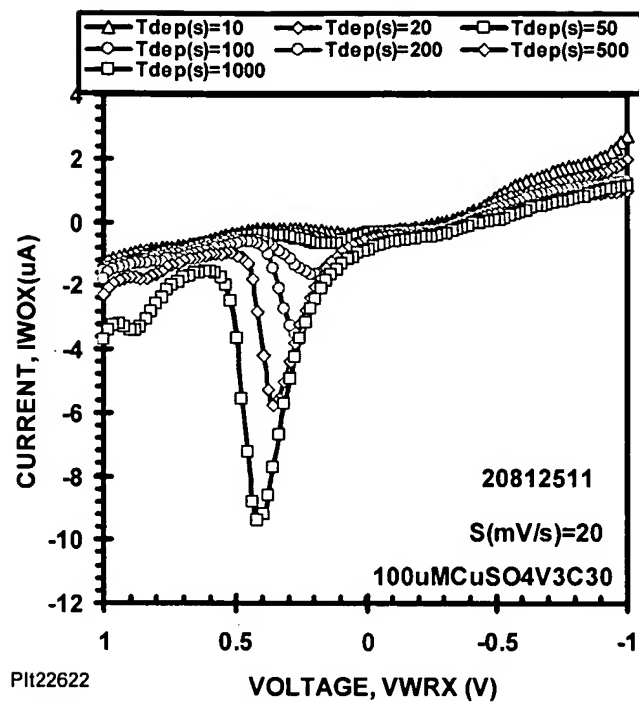


FIGURE 18A

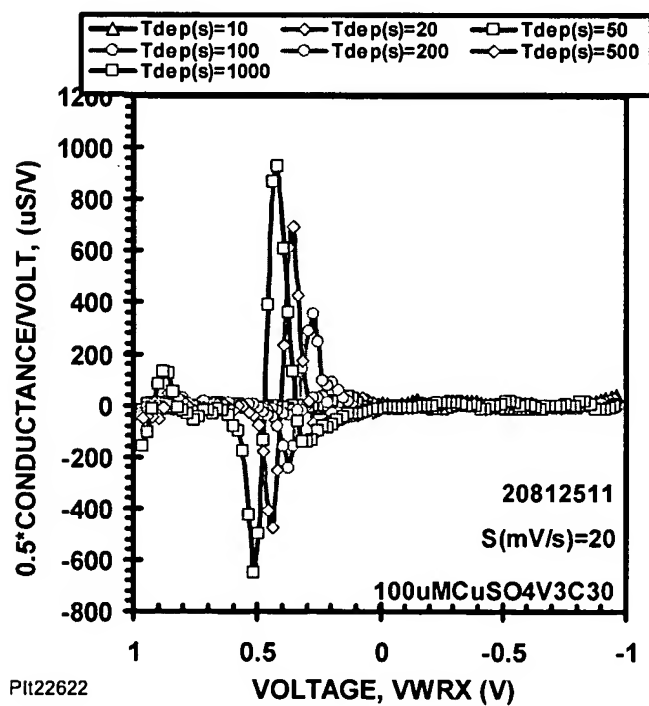


FIGURE 18B

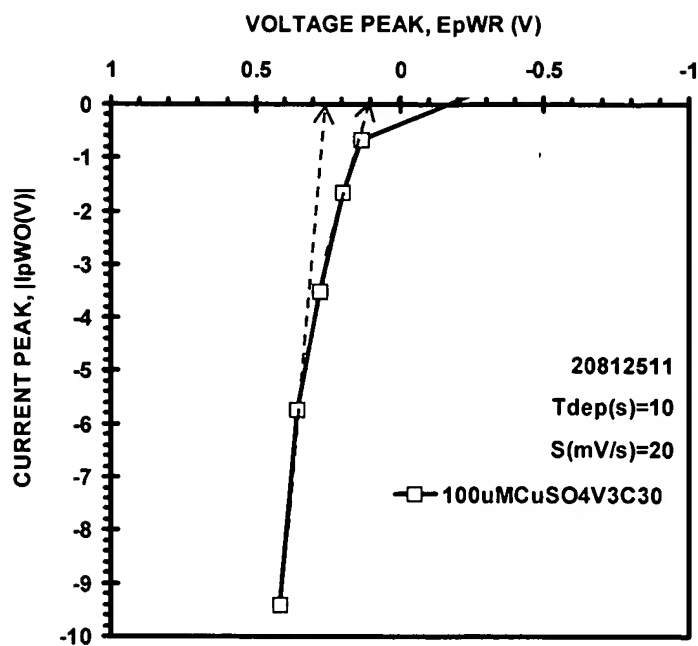
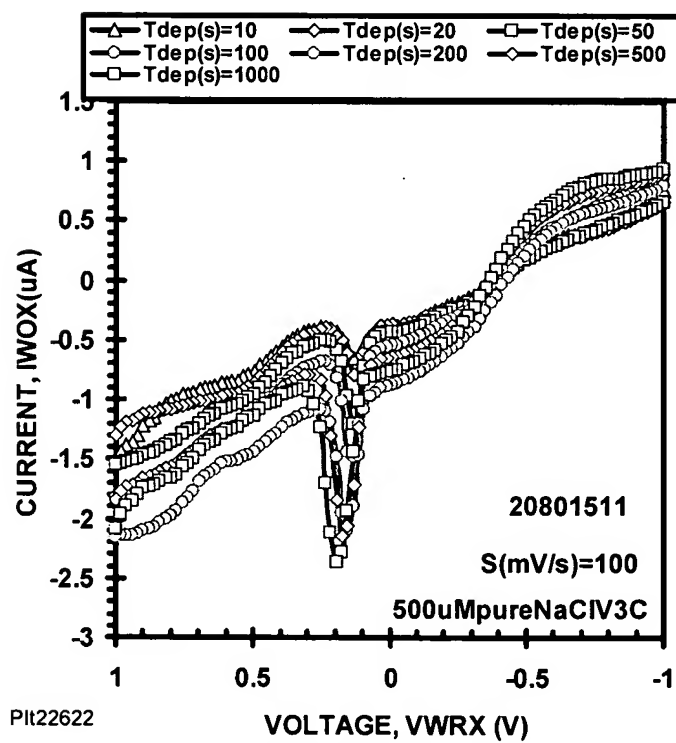


FIGURE 18C



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FIGURE 19A

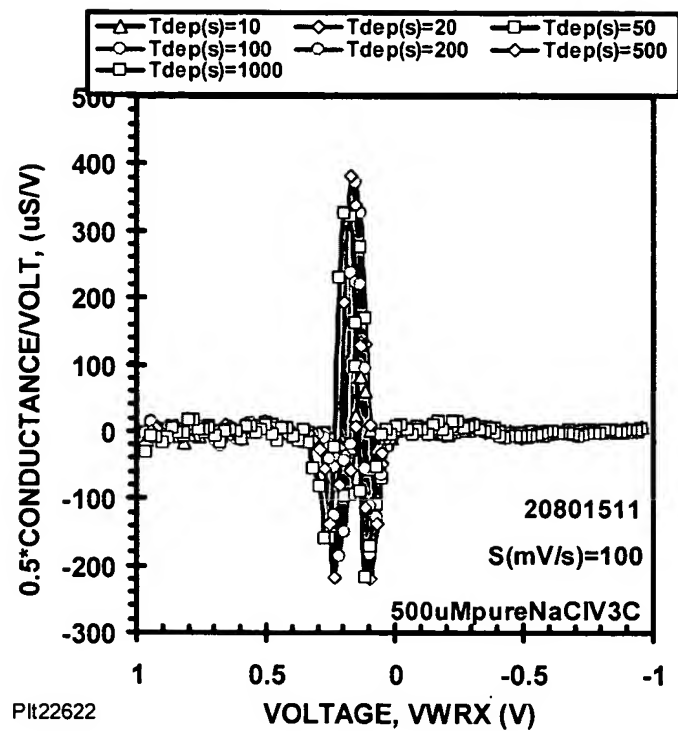


FIGURE 19B

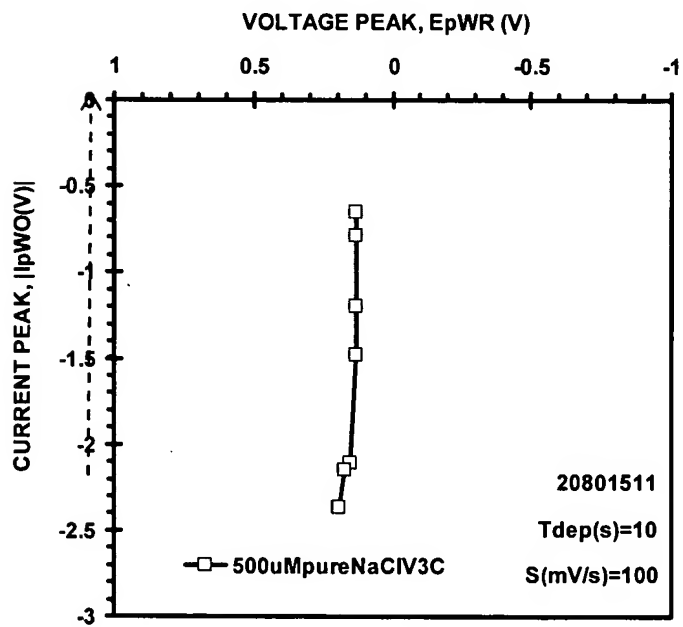


FIGURE 19C

Sym	Reaction	$E^\circ$	$E^\circ_{\text{corr}}$	$E_{p0}$	$E_0$
Cu2	$\text{Cu}^+ + e = \text{Cu}$	0.521	0.284	0.28	.331
Cu1	$\text{Cu}^{2+} + 2e = \text{Cu}$	0.342	0.224	0.133	.141
Ag	$\text{Ag}_2\text{O} + \text{H}_2\text{O} + 2e = 2\text{Ag} + 2\text{OH}^-$	0.342	0.244	0.09	.133
Pb2	$\text{Pb}^{2+} + 2e = \text{Pb}$	-0.126	-0.244	-0.4	-0.349
Pb1	$\text{PbCl}_2 + 2e = \text{Pb} + 2\text{Cl}^-$	-0.2675	-0.386	-0.65	-0.599
Zn2	$\text{ZnOH}^+ + \text{H}^+ + 2e = \text{Zn} + \text{H}_2\text{O}$	-0.497	-0.615	-0.9	-0.849
Zn1	$\text{Zn}^{2+} + 2e = \text{Zn}$	-0.762	-0.880	-1.25	-1.199

FIGURE 20

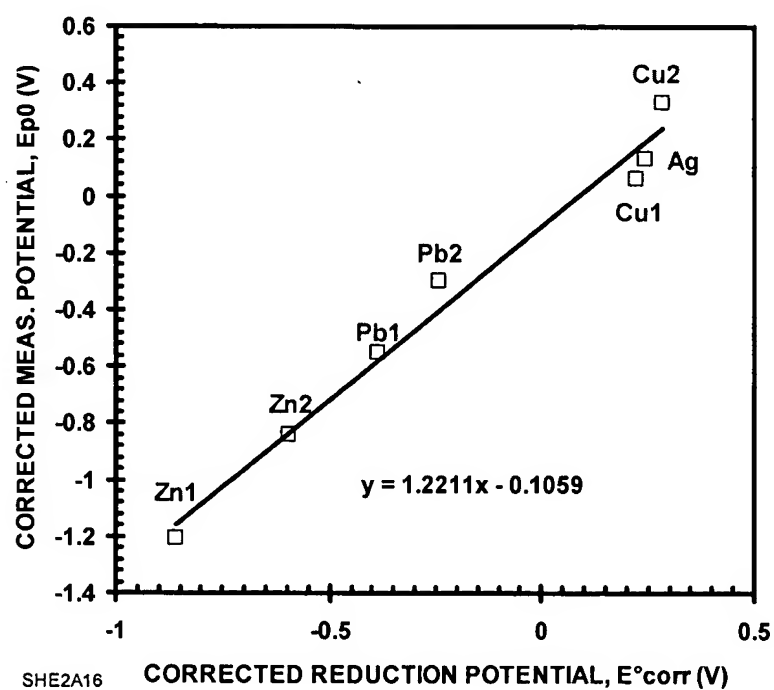


FIGURE 21

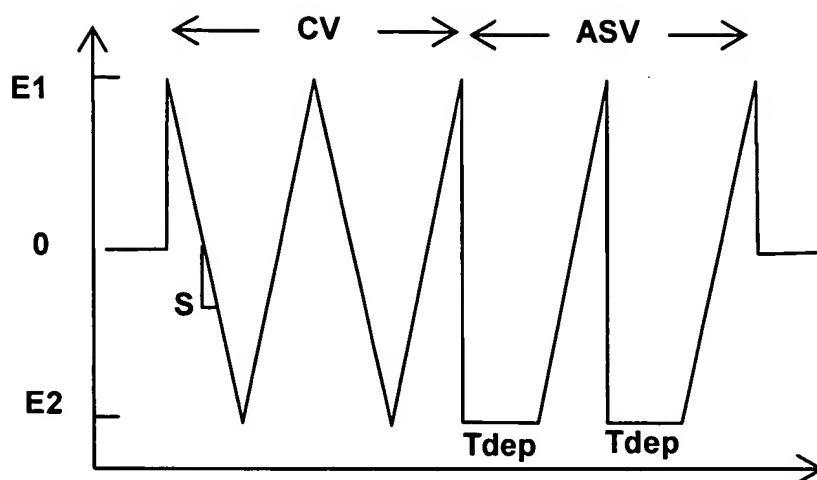


FIGURE 22

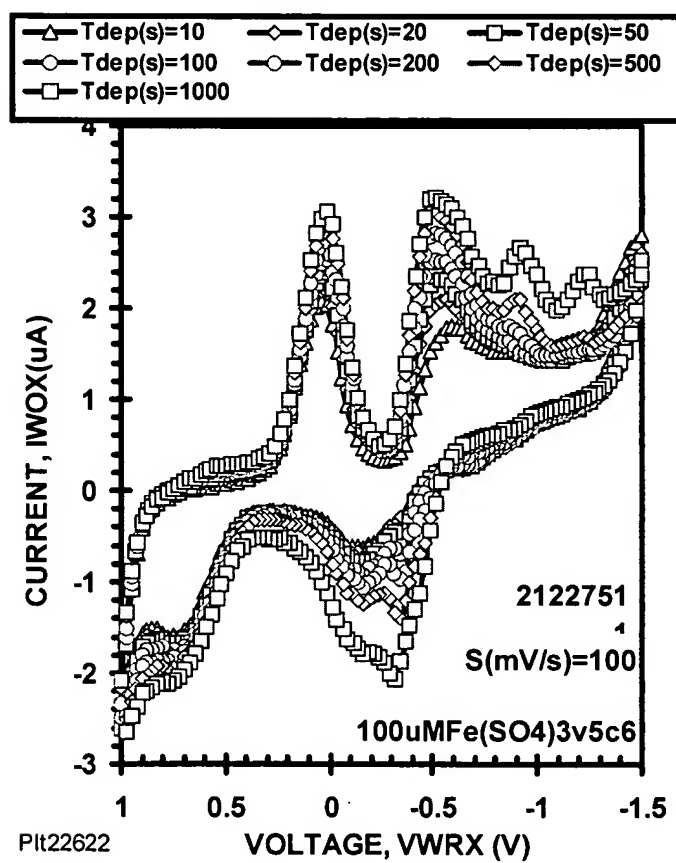


FIGURE 23

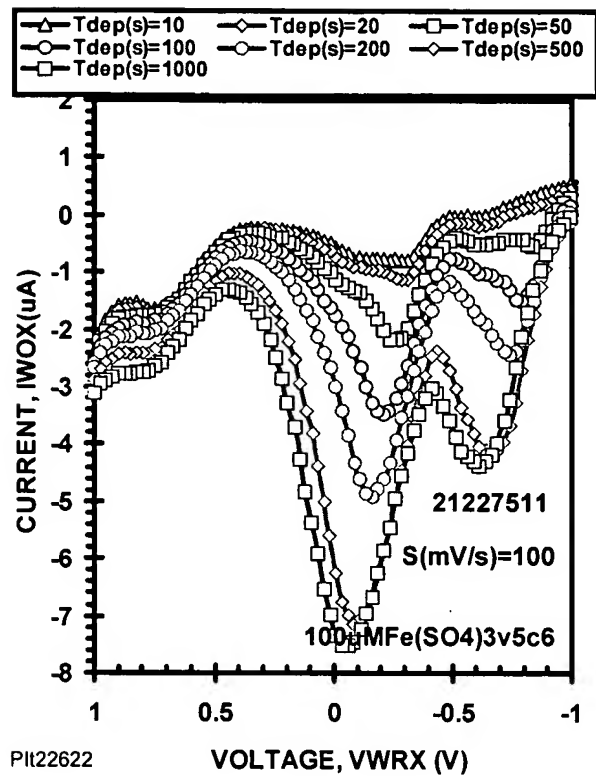


FIGURE 24

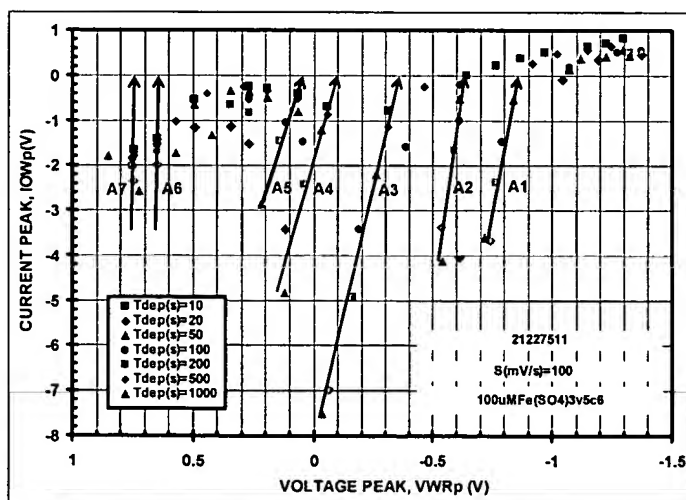


FIGURE 25

NO.	OXIDATION REACTIONS/NERNST EQN.
A1	$\text{Fe} = \text{Fe}^{2+} + 2\text{e}^-$ $E1 = -0.440 + 0.0295 \cdot \log(\text{Fe}^{2+})$
A2	$\text{Fe} + 2\text{H}_2\text{O} = \text{Fe}(\text{OH})_2 + 2\text{H}^+ + 2\text{e}^-$ $E2 = -0.047 - 0.059 \cdot \text{pH}$
A3	$\text{Fe}(\text{OH})_2 + \text{H}_2\text{O} = \text{Fe}(\text{OH})_3 + \text{H}^+ + \text{e}^-$ $E3 = -0.271 - 0.059 \cdot \text{pH}$
A4	$\text{Fe} = \text{Fe}^{3+} + 3\text{e}^-$ $E4 = -0.037 + 0.020 \cdot \log(\text{Fe}^{3+})$
A5	$\text{Fe}^{2+} + 3\text{H}_2\text{O} = \text{Fe}(\text{OH})_3 + \text{H}^+ + \text{e}^-$ $E5 = 1.057 - 0.177 \cdot \text{pH} + 0.059 \cdot \log(\text{Fe}^{2+})$
A6	$\text{Fe}^{2+} = \text{Fe}^{3+} + \text{e}^-$ $E6 = 0.771$
A7	TBD

FIGURE 26

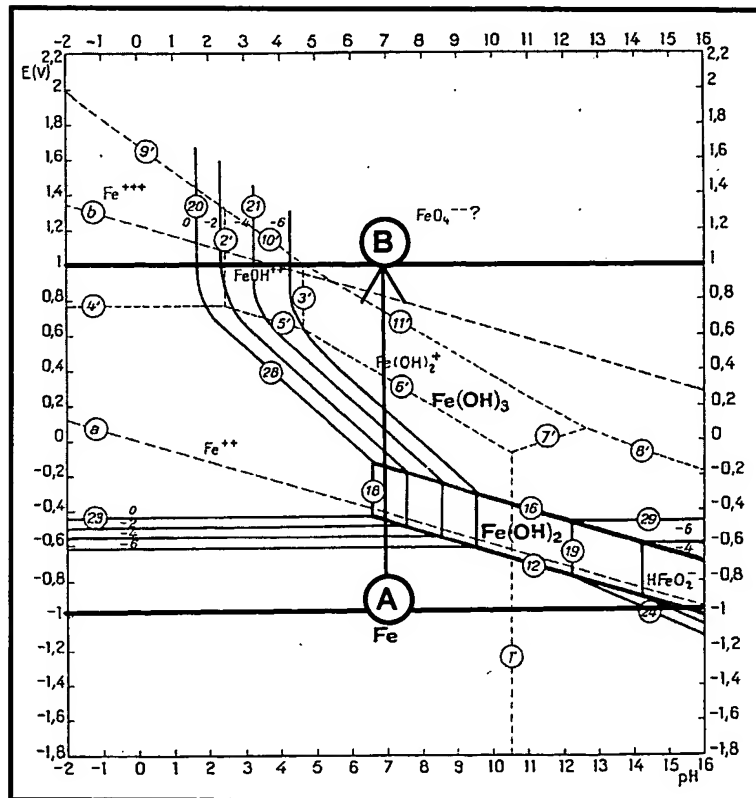


FIGURE 27

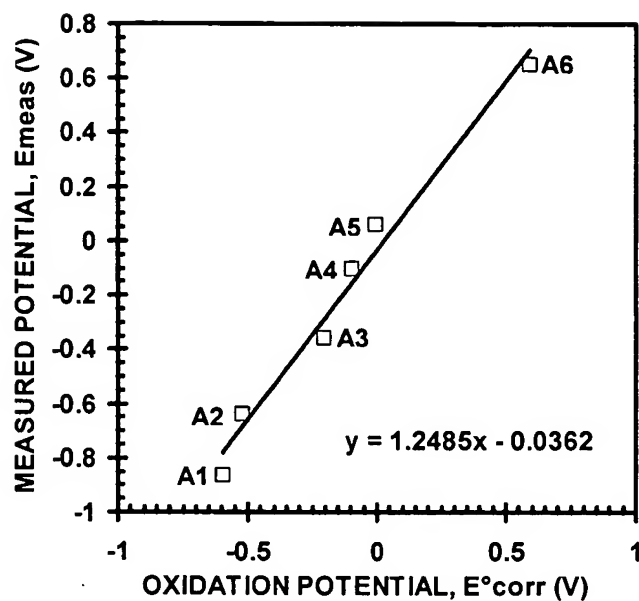


FIGURE 28

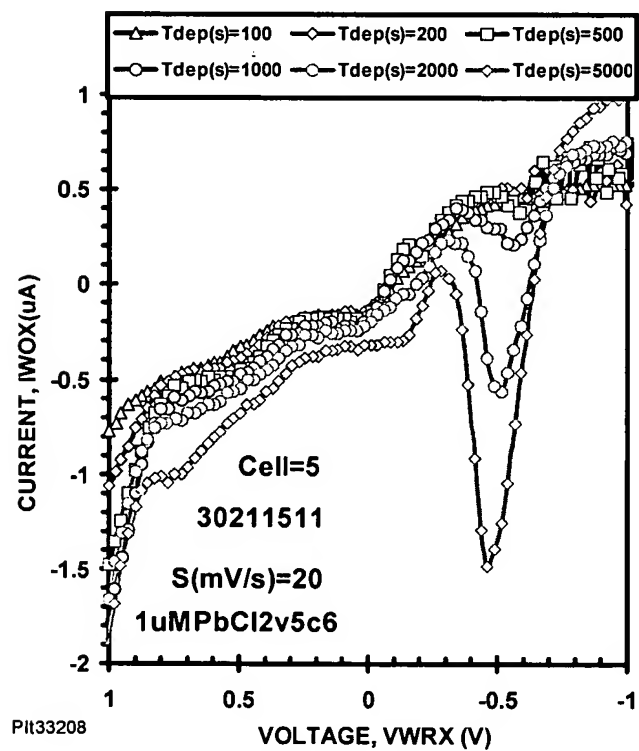


FIGURE 29



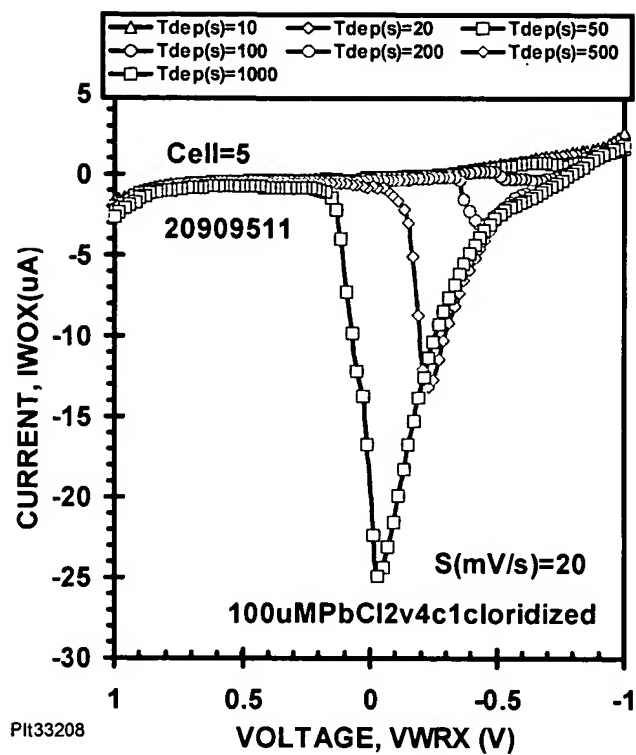


FIGURE 30

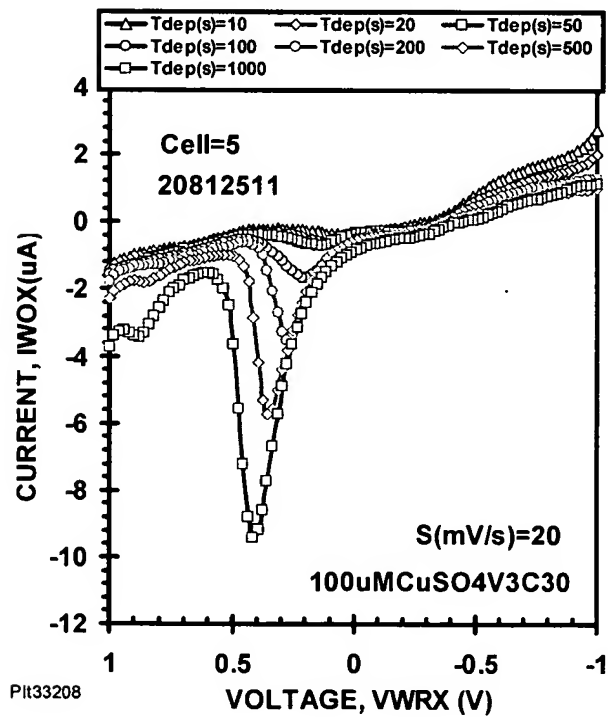


FIGURE 31

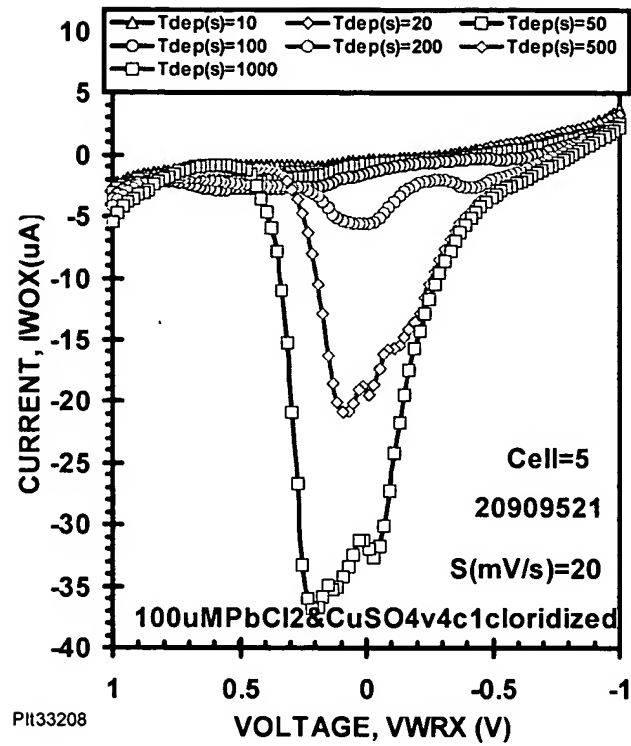


FIGURE 32

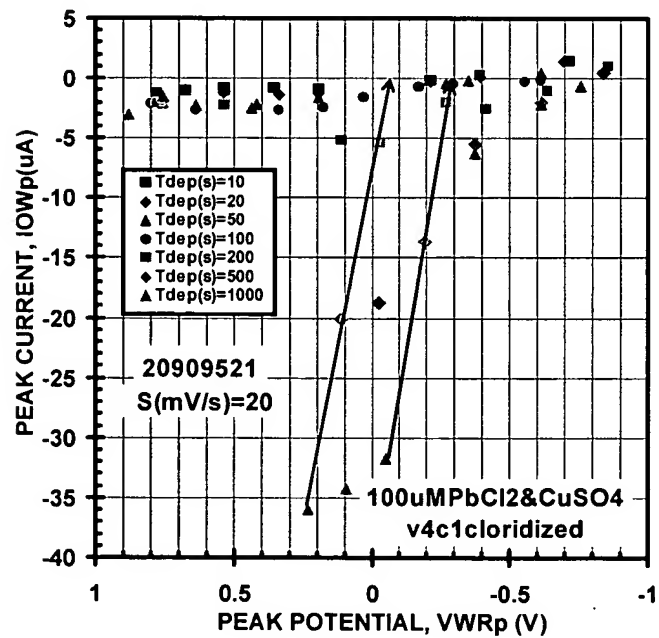


FIGURE 33

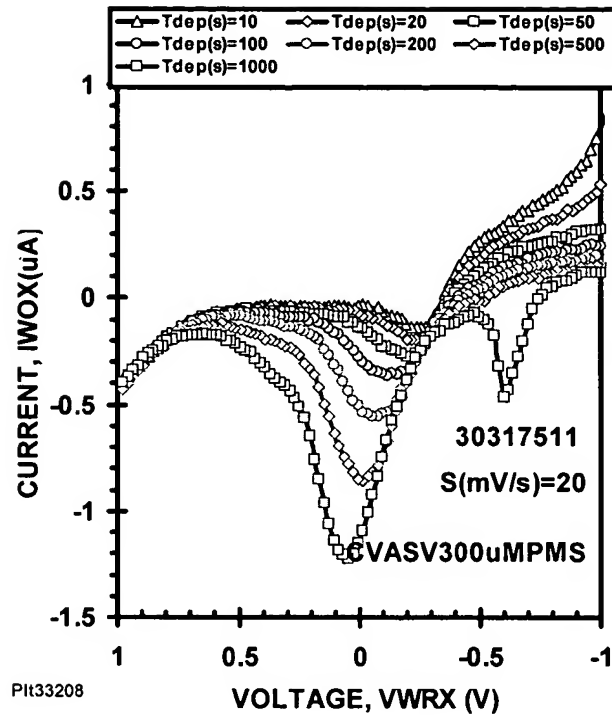


FIGURE 34

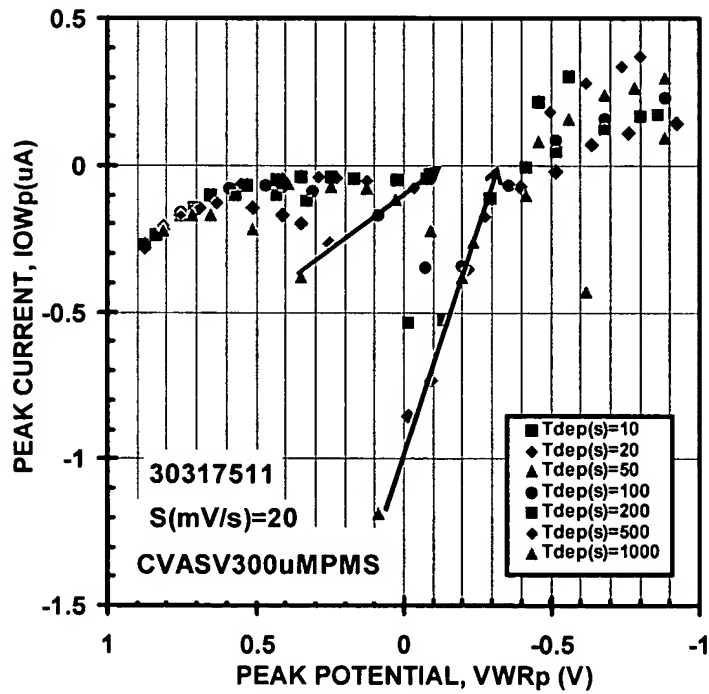


FIGURE 35

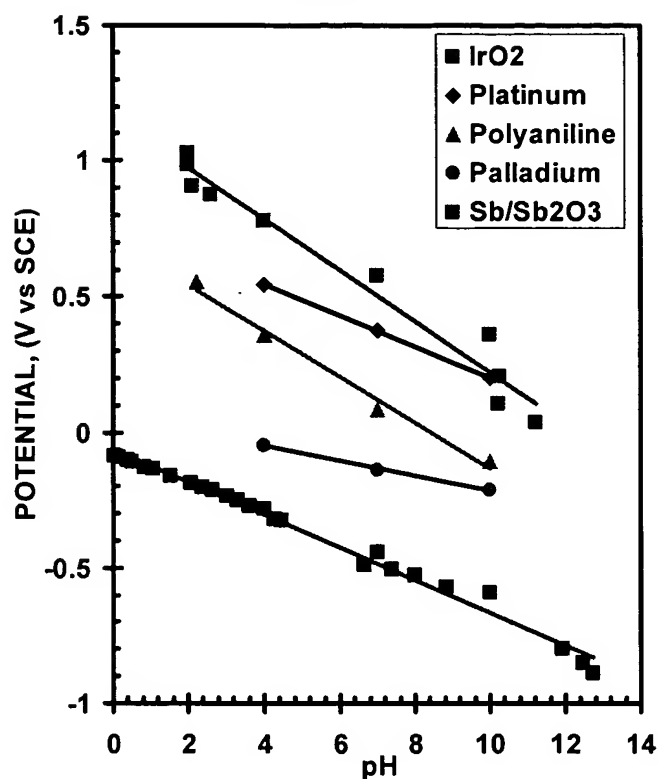


FIGURE 36

pH Sensor	ELECTRODEPOSITION CONDITION
Polyaniline	1 M aniline + 1 M H <sub>2</sub> SO <sub>4</sub> , pH < 1, Deposition current density = 4 mA cm <sup>-2</sup>
Platinum	1 g/l H <sub>2</sub> PtCl <sub>6</sub> + 176.4 g/l H <sub>2</sub> SO <sub>4</sub> , pH < 1, Deposition current density = -35 mA cm <sup>-2</sup>
Palladium	10 g/l Pd(NH <sub>2</sub> ) <sub>2</sub> (NO <sub>2</sub> ) <sub>2</sub> + 100 g/l ammonium sulfamate, pH = 7.5 to 8.5, Deposition current density = -1 to -20 mA cm <sup>-2</sup>
Antimony/Antimony Oxide	20 g/l K <sub>2</sub> (C <sub>4</sub> H <sub>4</sub> O <sub>6</sub> ).3H <sub>2</sub> O + 60 g/l Na <sub>2</sub> C <sub>4</sub> H <sub>4</sub> O <sub>6</sub> .2H <sub>2</sub> O, pH = 7, Deposition current density = -5 to -20 mA cm <sup>-2</sup>
Iridium oxide	1.5 g/l H <sub>2</sub> IrCl <sub>6</sub> + 5 g/l oxalic acid [(HCOO) <sub>2</sub> •2H <sub>2</sub> O] + 1 ml of hydrogen peroxide (H <sub>2</sub> O <sub>2</sub> ), pH = 10.5, Deposition current density < 1 mA cm <sup>-2</sup>

FIGURE 37

pH Sensing Materials	Sensitivity (mV/pH)
Polyaniline	-85
Platinum	-57
Palladium	-32
Antimony/Antimony Oxide	-55
Iridium oxide	-76

FIGURE 38

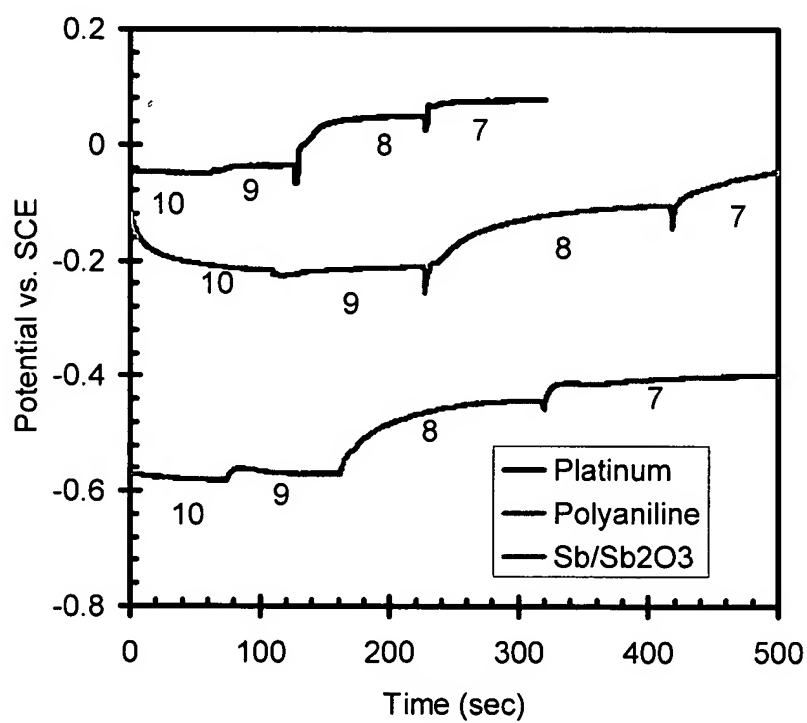


FIGURE 39

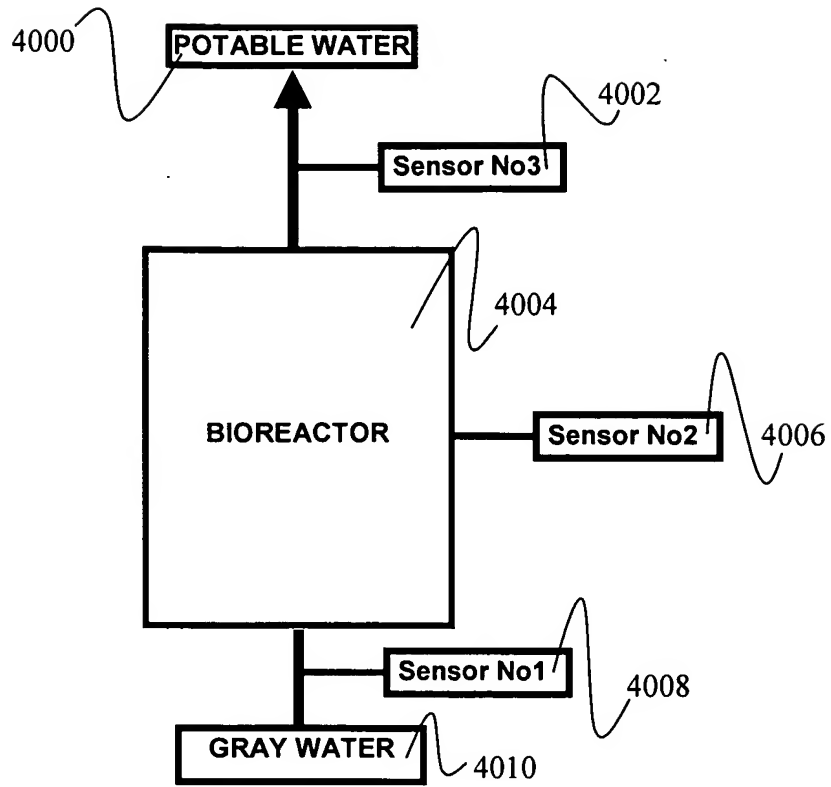


FIGURE 40

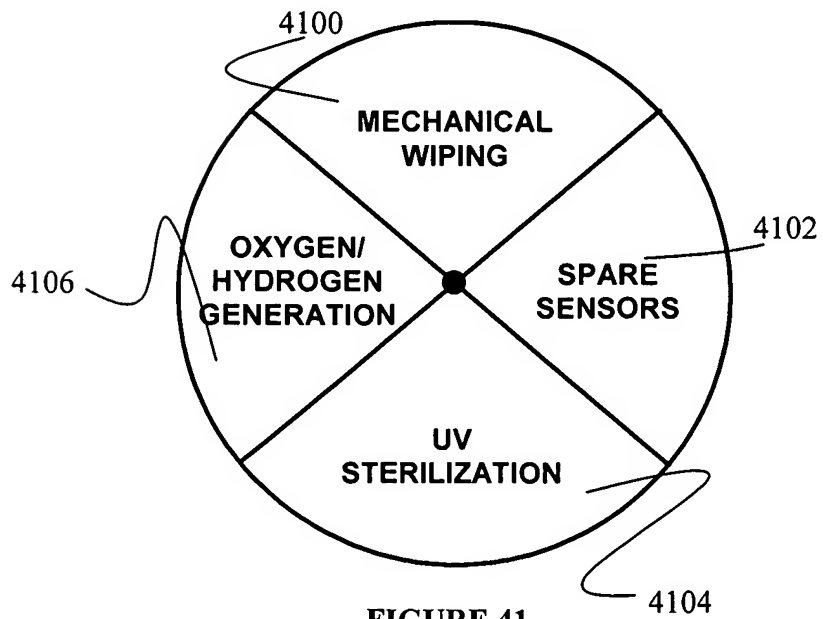


FIGURE 41